May 14, 1963 M. W. LAMPRECHT 3,089,361

FORGING MACHINE

Filed Dec. 1, 1959 8 Sheets-Sheet 1

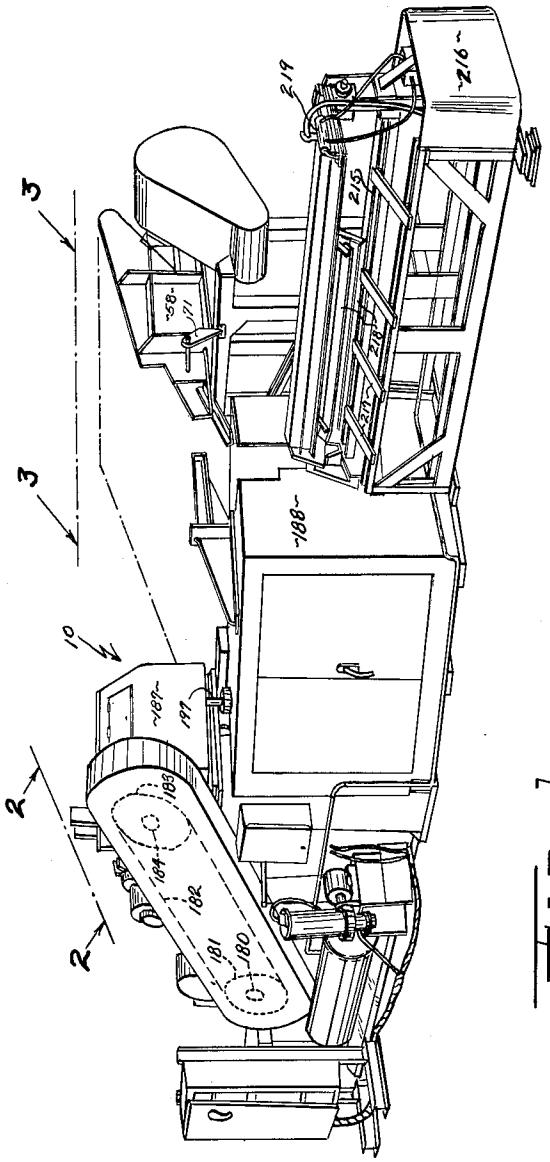


FIG. 1

INVENTOR.
MERLE W. LAMPRECHT
BY
Meyer, Baldwin, Doran & Young
ATTORNEYS

May 14, 1963 M. W. LAMPRECHT 3,089,361

FORGING MACHINE

Filed Dec. 1, 1959 8 Sheets-Sheet 2

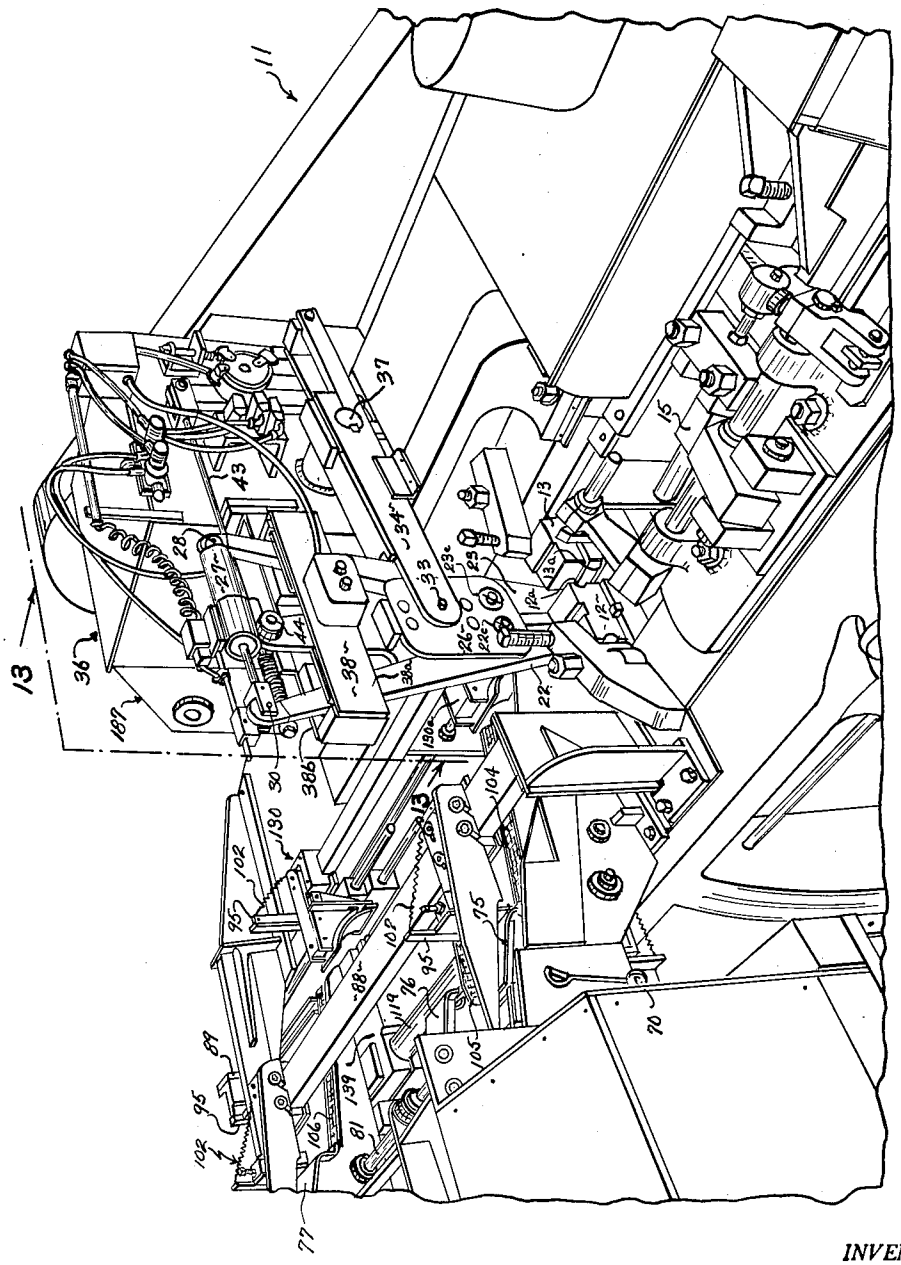


FIG. 2

INVENTOR.
MERLE W. LAMPRECHT
BY
Meyer, Baldwin, Doran & Young
ATTORNEYS

May 14, 1963 M. W. LAMPRECHT 3,089,361

FORGING MACHINE

Filed Dec. 1, 1959 8 Sheets-Sheet 3

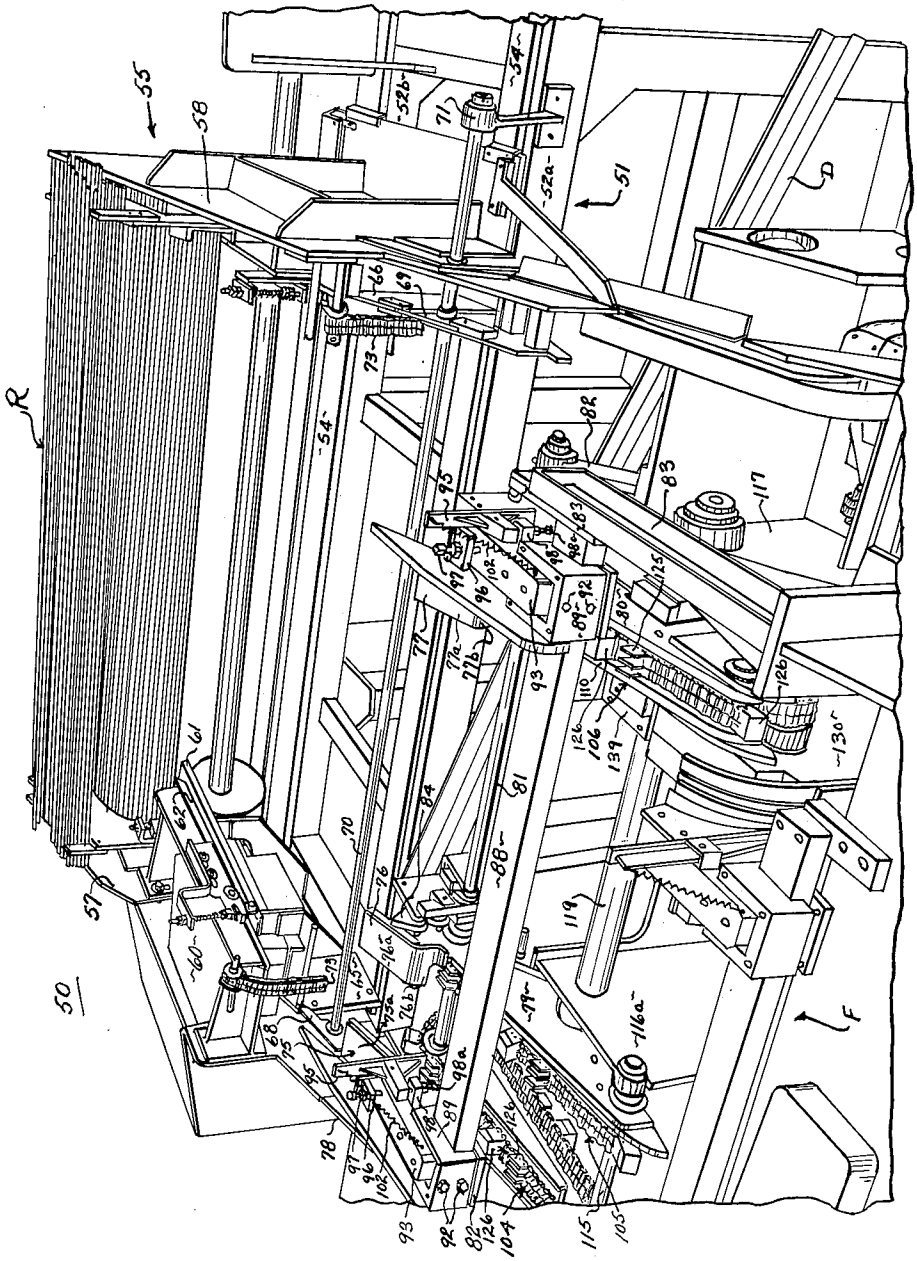


FIG. 5

INVENTOR.
MERLE W. LAMPRECHT
BY
Meyer, Baldwin, Doran & Young
ATTORNEYS

May 14, 1963 M. W. LAMPRECHT 3,089,361

FORGING MACHINE

Filed Dec. 1, 1959 8 Sheets-Sheet 4

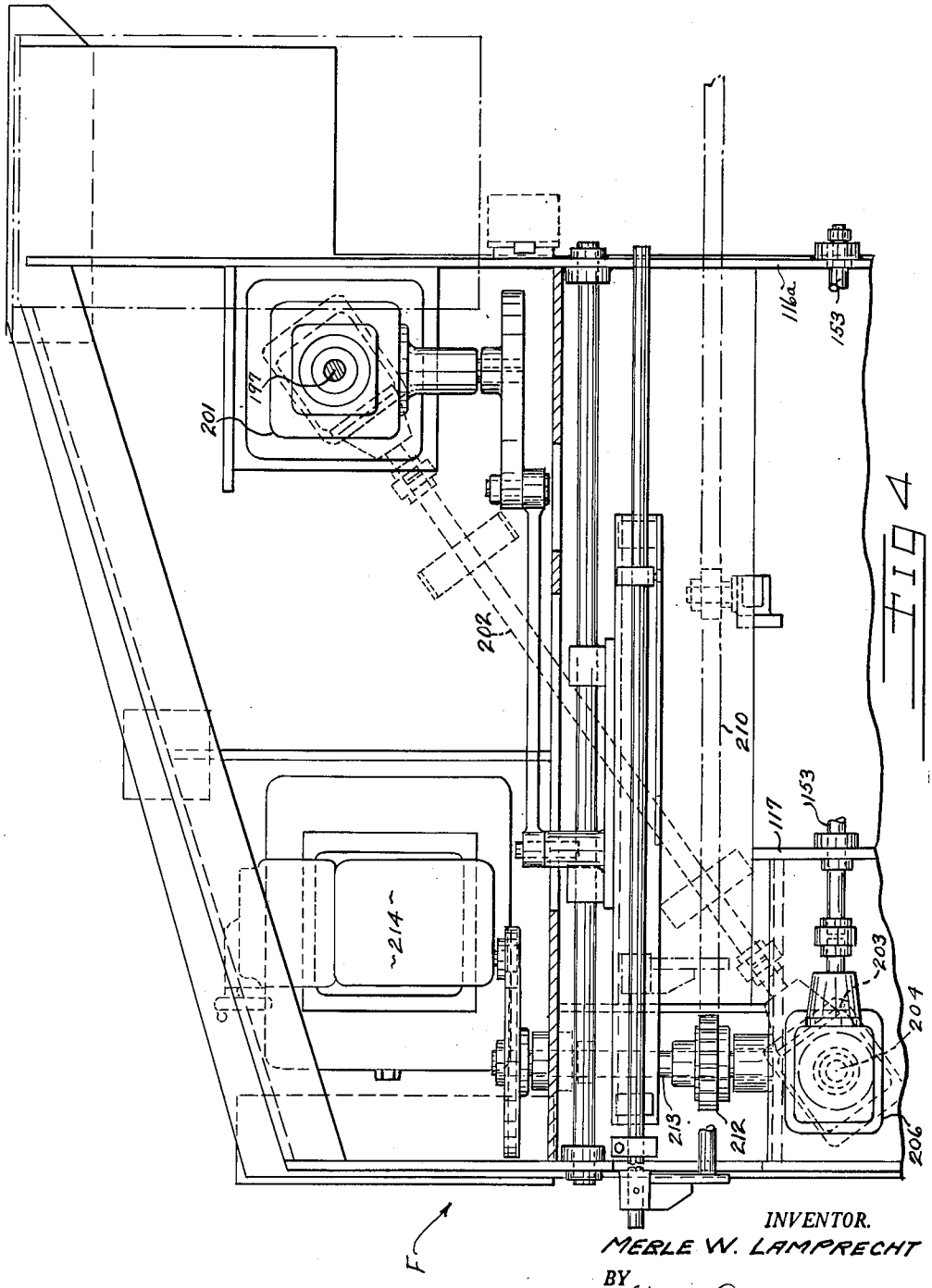


FIG 4

INVENTOR.
MERLE W. LAMPRECHT
BY
Meyer, Baldwin, Doran & Young
ATTORNEYS

May 14, 1963 M. W. LAMPRECHT 3,089,361

FORGING MACHINE

Filed Dec. 1, 1959 8 Sheets-Sheet 5

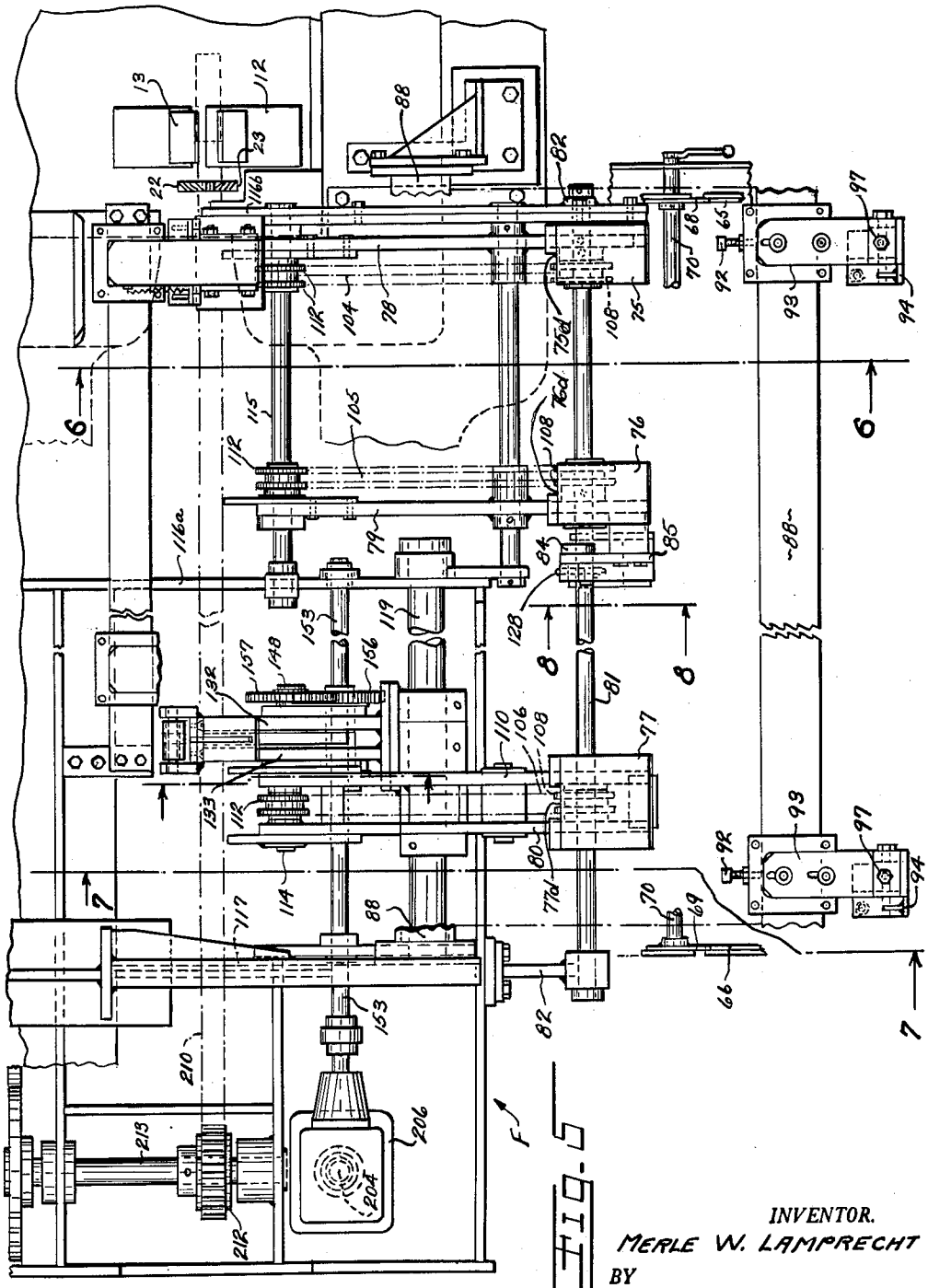


FIG. 5

INVENTOR.
MERLE W. LAMPRECHT
BY
Meyer, Baldwin, Doran & Young
ATTORNEYS

May 14, 1963 M. W. LAMPRECHT 3,089,361

FORGING MACHINE

Filed Dec. 1, 1959 8 Sheets-Sheet 6

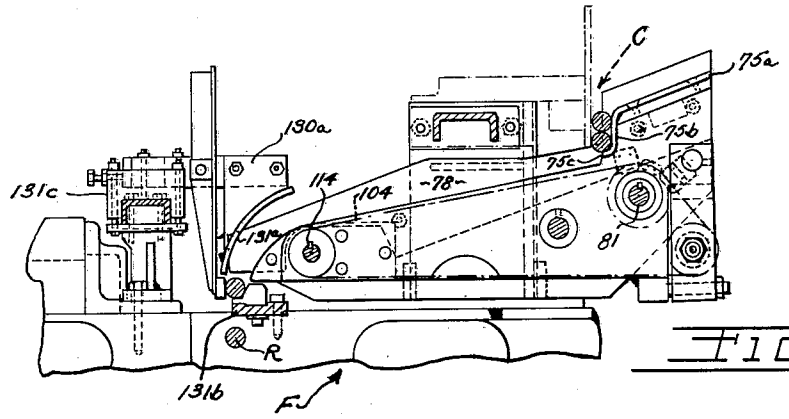


Fig. 6

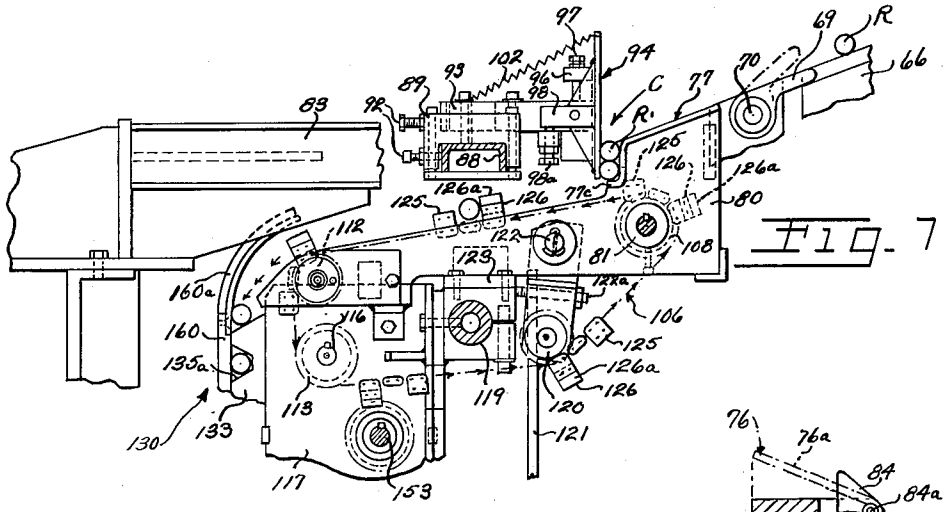


Fig. 7

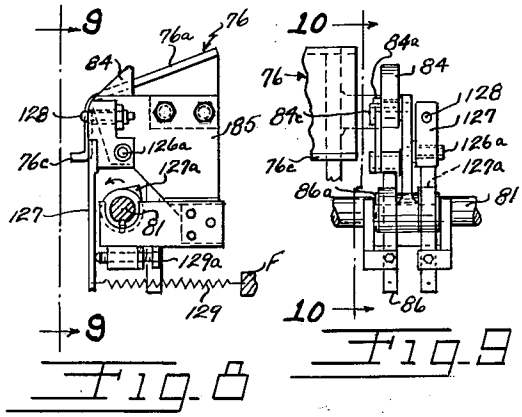


Fig. 8

Fig. 9

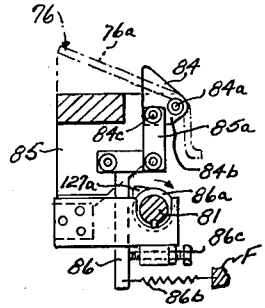


Fig. 10

INVENTOR.
MERLE W. LAMPRECHT
BY
Meyer, Baldwin, Doran & Young
ATTORNEYS

May 14, 1963 M. W. LAMPRECHT 3,089,361

FORGING MACHINE

Filed Dec. 1, 1959 8 Sheets-Sheet 7

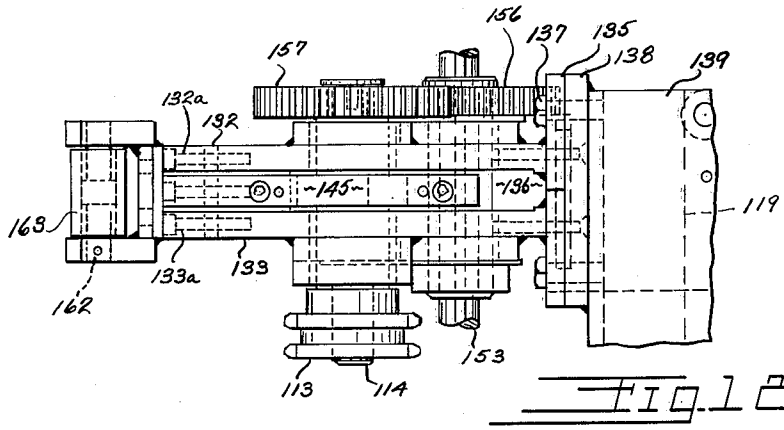


FIG. 12

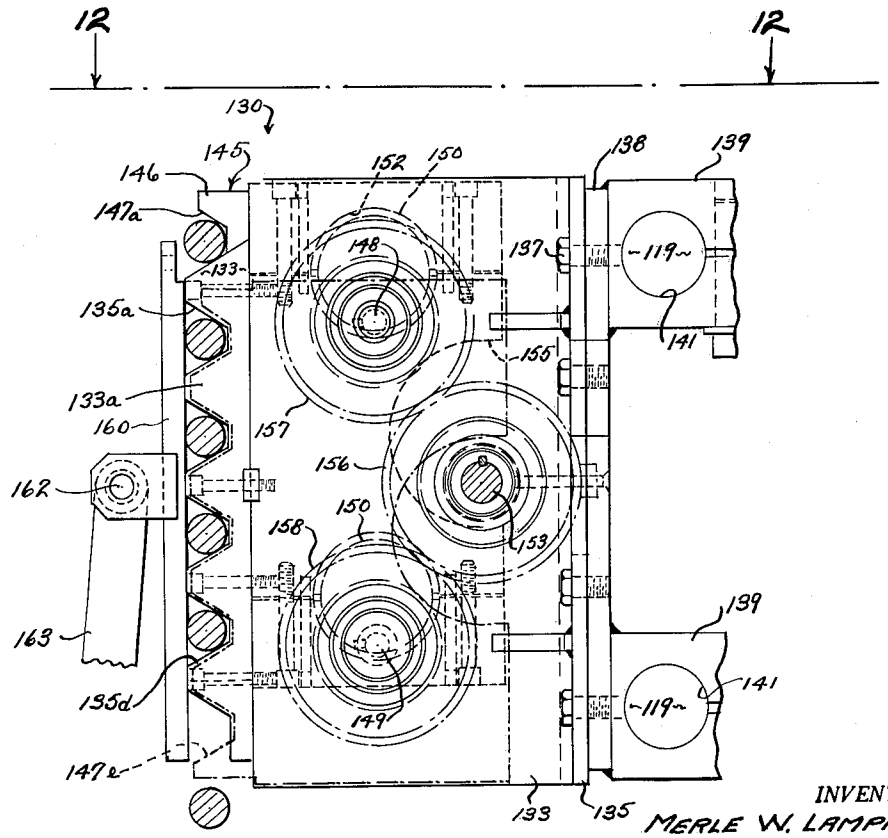


FIG. 11

INVENTOR.
MERLE W. LAMPRECHT
BY
Meyer, Baldwin, Doran & Young
ATTORNEYS

May 14, 1963 M. W. LAMPRECHT 3,089,361

FORGING MACHINE

Filed Dec. 1, 1959 8 Sheets-Sheet 8

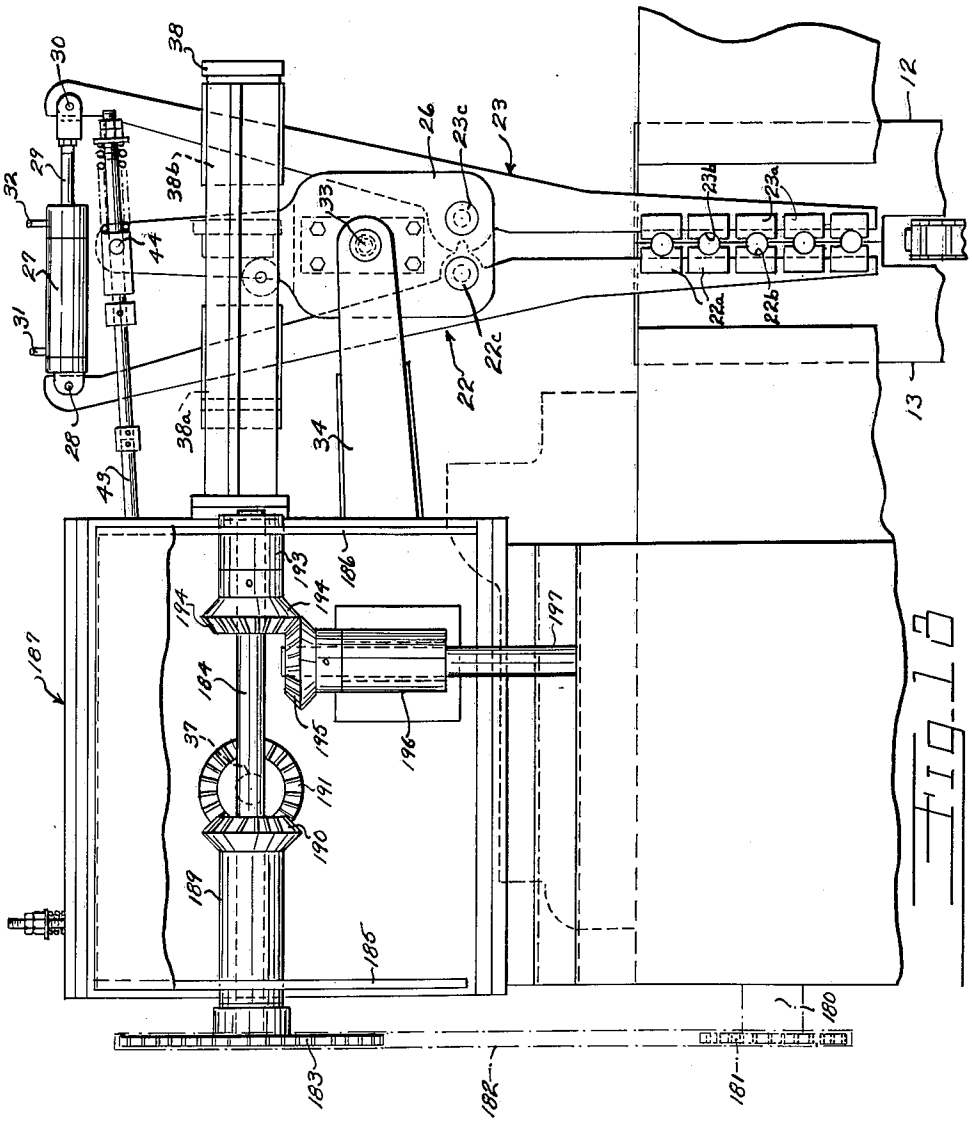


FIG. 18

INVENTOR.
MERLE W. LAMPRECHT
BY
Meyer, Baldwin, Doran & Young
ATTORNEYS

United States Patent Office

3,089,361
Patented May 14, 1963

3,089,361

FORGING MACHINE

Merle W. Lamprecht, Cleveland, Ohio, assignor to The Hill Acme Company, Cleveland, Ohio, a corporation of Ohio

Filed Dec. 1, 1959, Ser. No. 856,416
4 Claims. (Cl. 78—99)

This invention relates to improvements in forging machines, and more particularly to workpiece delivery and feeding apparatus especially designed for use with a forging machine of the type disclosed in my United States Patent 2,835,152 as to provide an automatic cycle of fabrication or forging of a workpiece by said machine.

A primary object of the present invention is the provision of a new and novel workpiece delivery and feeding apparatus for use with a material fabricating machine and which apparatus is especially designed to deliver a workpiece to said machine in such manner as to enable an automatic cycle of fabrication of said workpiece to be accomplished by said machine.

Another object of the present invention is to provide a new and novel workpiece delivery and feeding apparatus especially designed for use with a forging machine of the type referred to, and which apparatus is operable to deliver a workpiece to said machine in such manner as to enable an automatic progressive cycle of fabrication or forging of said workpiece to be accomplished by said machine.

Still another object of the present invention is the provision of a new and novel workpiece delivery and feeding apparatus for use with a forging machine as to enable an automatic progressive cycle of fabrication or forging of a workpiece to be accomplished by said machine, and further wherein said apparatus includes means to progressively present a plurality of workpieces at any one time to said machine.

Another object of the present invention is the provision of new and novel workpiece delivery and feeding apparatus for use with a forging machine having a working head, and wherein said apparatus is especially designed to sequentially deliver lengths of rod material to said head and in such manner as to be operable to progressively present each of said rod lengths to said machine as to enable an automatic cycle of fabrication or forging of each workpiece to be accomplished by said forging head.

Still another object of the present invention is the provision of a new and novel workpiece delivery and feeding apparatus for use with a forging machine having a working head, and wherein said apparatus includes means defining a workpiece conveyance path, means for conveying a workpiece along said path, being thereafter operable to present said workpiece to said working head in such manner as to enable an automatic progressive cycle of fabrication or forging of said workpiece to be accomplished by said machine.

Still another object of the present invention is the provision of a new and novel workpiece delivery and feeding apparatus as hereinabove described, and wherein said apparatus is further characterized by having means for sequentially delivering a plurality of workpieces singly to the working head of the machine in timed relation to each other and further wherein said apparatus includes means whereby each of said workpieces is successively presented to said working head to thus provide a continuous automatic progressive cycle of fabrication or forging of said workpiece by said machine.

Another object of the present invention is the provision of a new and novel workpiece delivery and feeding apparatus for use with a material fabricating machine and

wherein said apparatus includes means defining a workpiece conveyance path, means for transporting a workpiece along said path and which is operable to transport said workpiece to said forging head, and means operable with said transporting means effective to successively present said workpiece to said machine to thus enable an automatic cycle of fabrication of the same to be accomplished by said machine.

It is a further object of the present invention to provide novel workpiece delivery and feeding apparatus for use wtih a forging machine which uses a pair of workpiece gripping fingers working adjacent the forging head, and which, in cooperation with said apparatus supports a workpiece as the same is presented to said head as to enable an automatic progressive cycle of fabrication to be accomplished by said machine.

Additional objects and advantages of the present invention will be hereinafter realized by one skilled in the art to which it pertains, and upon reference to the following description of a preferred embodiment thereof, and which is shown in the drawings accompanying this specification and included as a part thereof, and wherein:

FIG. 1 is a perspective elevational view of a forging machine utilizing the delivery and feeding apparatus embodying the concepts of the present invention;

FIG. 2 is a fragmentary perspective end view of the machine in FIG. 1 looking somewhat in the direction of the arrows 2 therein;

FIG. 3 is a fragmentary perspective view looking in the direction of the arrows 3 in FIG. 1, and showing the delivery and feeding apparatus of the present invention, as disposed in its preferred location relative to the forging machine.

FIG. 4 is a fragmentary top plan view of the forging machine control drive, and showing the connection between it and drive means for the delivery and feeding apparatus of the present invention;

FIG. 5 is a fragmentary top plan view of the delivery and feeding apparatus of the present invention;

FIG. 6 is a fragmentary view in elevation, taken along the plane as indicated by line 6—6 in FIG. 5, and showing in particular one end of the delivery and feeding apparatus of the present invention;

FIG. 7 is a fragmentary view in elevation taken approximately on the plane as is indicated by the line 7—7 of FIG. 5 and showing still another part of the delivery and feeding apparatus;

FIG. 8 is an elevational view taken approximately on the plane as indicated by the line 8—8 of FIG. 5;

FIG. 9 is a view taken approximately on the plane as indicated by the line 9—9 of FIG. 8;

FIG. 10 is an elevational view taken approximately on the plane as indicated by the line 10—10 as shown in FIG. 9;

FIG. 11 is a fragmentation elevational view of the delivery and feeding apparatus of the present invention taken approximately on the plane as indicated by the line 11—11 in FIG. 5;

FIG. 12 is a top plan view looking in approximately the direction as indicated by the line 12—12 in FIG. 11; and,

FIG. 13 is a front view in elevation of the embodiment of workpiece manipulating fingers utilized in the instant forging machine assembly looking in approximately the direction as indicated by the arrows 13 in FIG. 2.

While the delivery and feeding mechanism of my invention has utility with various kinds of material fabricating machines, it is especially adapted for use with a forging machine of the type as is fully described in my United States Patent No. 2,835,152, and wherein reference may be had to said patent for a more complete de-

scription of said forging machine and manipulating mechanism.

Referring now to the drawings, the embodiment of forging machine herein shown, incorporates the basic forging machine structure as is described in the heretofore mentioned patent, and is identified in its entirety by the reference numeral **10**, and as best seen in FIG. 2 comprises a forging head **11** which, in turn, includes a pair of vertically disposed workpiece gripping dies as identified at **12** and **13**, respectively, the die **12** being hereafter also referred to as a fixed die; whereas the die **13** is also hereinafter referred to as the movable die and which is intended to be cyclically moved toward and away from its companion die **12** as will be hereinafter more clearly defined.

The forging head also includes a header slide **15** which, as is described in the aforesaid patent, is of substantial mass and located forwardly of said gripping dies **12** and **13**, being reciprocally driven thereat in a horizontal plane and having in turn, a working face carrying one or more forging dies and/or tools cooperating with the adjacent faces of the said gripping dies to deliver a forging or fabricating blow to the workpiece held by the latter.

As described in the aforementioned patent, the instant forging machine is of the type which progressively forges a workpiece. That is to say, the workpiece is repeatedly presented to the header slide and cooperating gripping dies in such manner that its fabrication is accomplished through a plurality of forging strokes of said slide.

To accomplish this, a series of recesses is formed on the mutually facing sides of each of said gripping dies, said recesses being identified respectively by the reference numerals **12***a* and **13***a*. The recesses are disposed in vertical spaced relation on each of said gripping dies, and with the latter in abutting relation, the recesses of each series mate with the corresponding recesses of the other series to thus form cavities into which the workpieces are disposed during the forging process. Preferably, the recesses are of such dimension that each workpiece is securely held by the gripping dies during said process.

In the process of forging a workpiece, it is initially disposed and securely held within the uppermost gripper die cavity at which time the header slide is brought forward in its forging stroke to thus provide an initial upsetting of the exposed end of the workpiece. I designate the header slide as moving in its forward direction when it is approaching the gripper dies and in its reverse direction when it is retreating from said dies.

At the completion of the initial forging stroke of the header slide, the cyclic operation of the forging machine is such that the gripper dies **12** and **13** are opened, and the workpiece is then moved downward therebetween to the next mating pair of gripper die recesses. The gripper dies are then closed to hold the workpiece at said new location and the header slide then completes a second forging stroke. This cyclic operation is continued until the forging process is completed.

During the interval when the first mentioned workpiece is moved to its second position as just described, a new workpiece may be moved into position so as to be disposed within the uppermost die cavity, of the gripping dies, and hence in position for the initial upsetting of its exposed end to be performed by the header slide.

After the completion of each forging stroke of the header slide, the workpieces already in the process of fabrication are moved to the next lower position between the gripping dies **12** and **13** and a new workpiece is also placed at said first position between said dies. Thence, as the workpieces are moved downward through the gripping dies **12** and **13** they are progressively fabricated and at the completion of said process are thence released from the said dies and discharged from the machine by means as will be hereinafter more fully described.

As previously mentioned, I also prefer to use additional workpiece transfer means in the present embodiment of forging machine to assist in the proper transfer of each workpiece through the gripping dies **12** and **13** during the forging process.

For this purpose, I prefer to use a pair of transfer fingers **22** and **23** of the type and generally corresponding to the transfer fingers 36 and 37 described in my aforesaid Patent 2,835,152. As best seen in FIG. 13, each of the instant transfer fingers **22** and **23** is likewise provided with a plurality of work gripping dies **22***a* and **23***a*, respectively, each having a semi-circular recess formed centrally therein as indicated at **22***b* and **23***b*, said fingers being pivotally mounted at **22***c* and **23***c* to a suitable mounting plate **26**.

Means are also provided in the instant structure for causing the opening and closing of the fingers **22** and **23**, and for this purpose, a double-acting pressure fluid motor is preferably used having a cylinder member **27** pivotally connected to the top of finger **22** at **28**, and having its piston rod member **29** pivotally connected to the upper end of finger **22** at the pivot point **30**. Suitable pressure fluid inlet and outlet pipes **31** and **32** are provided at oppoiste ends of the cylinder **27** to connect the same to a suitable source of pressure fluid. With this construction, it will be realized that upon proper actuation of the motor, the fingers **22** and **23** may be pivoted about the aforementioned pins **22c** and **23c** to an open position or to a closed position.

The corresponding fingers **22** and **23** of the instant forging machine, like the corresponding fingers of my patented structure are also intended to be actuatable relative to the gripping dies **12** and **13** to thus carry the workpiece or workpieces progressively through the latter during the forging process.

To accomplish this, the finger mounting plate **26** is seen to be pivotally attached at **33** to one end of a lever **34**. This lever **34**, like the lever **71** of my patented machine structure is likewise intended to be driven by the drive shaft **37** so as to raise and lower the fingers **22** and **23** between the gripping dies **12** and **13**. In the instant structure, the fingers **22** and **23** are supported within a guide rail **38** having opposed bearing plates **38***a* and **38***b* adapted to embrace said fingers. And, as will be hereinafter described, the actuation of shaft **37** and lever **34** and hence the raising and/or lowering of the fingers **22** and **23** is in timed relation with the reciprocation of the header slide during the foregoing process.

As is previously mentioned, the gripping die **12** is fixed in place, and consequently when it is desirable to move the workpiece and/or workpieces downwardly between said dies, to thus properly locate the same for the next forging stroke of the header slide, it is first required to remove said workpiece and/or workpieces from the recesses **12***a* in said fixed die. The movable die **13**, as will be recalled, is moved away from the fixed die **12** between the forging strokes of the header slide and then the workpieces are removed from the recesses **13***a* thereof.

The gripping fingers **22** and **23**, while the header slide is in its forging stroke, are in their uppermost opened position, and the gripping dies **12** and **13** are holding the workpiece and/or workpieces firmly within their respective recesses **12***a* and **13***a*. During this interval, the header slide moves forward in its forging stroke to forge said workpiece and/or workpieces.

At the completion of the working or forging stroke of the header slide **15**, it is thence returned to its remote position relative to the gripping dies **12** and **13**.

During this latter interval, the gripping fingers **22** and **23** are closed to firmly grasp the workpiece and/or workpieces held by said gripping dies. Just prior to the closing of the fingers, a new workpiece to be fabricated is presented to said fingers and disposed so as to be held within the uppermost recesses therein.

Next, the movable gripping die **13** is moved away from its companion fixed die **12** and the gripping fingers **22** and **23** are then tilted about their pivotal connections to release the workpiece and/or workpieces from the recesses

13*a* of said movable die. Next, said fingers are moved downwardly adjacent the rear faces of said gripping dies 12 and 13 to carry the workpiece and/or workpieces to the next lower position in the forging cycle. Next, the gripping die 13 is moved to its closed position against die 12 to hold the workpiece and/or workpieces in their adjusted position, the newly presented workpiece being disposed in the aforesaid uppermost position between said dies, and the fingers 22 and 23 are then opened and returned to their raised opened position. Thereafter, the header slide 15 is moved toward the gripping dies 12 and 13 and carried through its forging or working stroke to complete the cycle of operation of said assembly.

The novel delivery and feeding apparatus of the present invention which is especially designed for use with the forging machine thus far described is herein disclosed as being operable with the workpiece gripping fingers as to provide adequate support for substantially long lengths of rod elements, for example, lengths of rod to be used as mine roof bolts in mining installations or the like and which may be several or more feet in length.

Although the instant delivery and feeding apparatus, as will be hereinafter described, is preferably utilized with the aforementioned workpiece gripping fingers, it will also be hereinafter realized that said apparatus may be used without said cooperating fingers so as to provide adequate support and delivery of said rod material to the forging head of the forging machine.

Referring now particularly to FIG. 3, the delivery and feeding mechanism of the present invention, as herein identified in its entirety by the reference numeral 50, is seen to include a table-like supporting frame 51 having a pair of upper rail members 52*a* and 52*b* at the front and rear sides respectively of said frame and extending longitudinally therealong, preferably in parallel spaced relation to each other. Mounted and securely attached on the top of each of said rail members is a bar 54 substantially rectangular in cross section being preferably of less width than its supporting rail member and extending therealong as to define a trackway or bearing surface.

Said frame 51 supports a bin-like assembly as is indicated in its entirety by the reference numeral 55 and which is seen to be utilized to store a plurality of rod lengths to be fabricated by said machine, each of said lengths being identified by the reference character R. The bin assembly comprises a pair of vertically disposed plates defining end walls as identified by the reference numerals 57 and 58, said walls being preferably formed so as to provide for the support of the ends of said rods.

Although not herein specifically shown in detail, the bin assembly includes means effective to periodically discharge one of the aforesaid lengths of rod material to thus initiate its delivery to the forging head 11.

The instant embodiment of forging machine is intended to form a bolt-like head on the left end of each rod R as viewed in FIG. 3, said rod being preferably threaded on its opposite end; the completed fabricated rod defining a mining roof bolt being thus utilized, as previously mentioned in mining installations or the like for retaining a roof or ceiling in place.

The head on each of said rods is preferably formed thereon while said rod end is in a heated condition. For this purpose, as best seen in FIG. 3, the aforementioned frame 51 mounts a suitable heating device such as an induction heater of conventional design, as is indicated in its entirety by the reference numeral 60 and which is seen to include a narrow platform 61 which has its one end closely adjacent the lengths of rod being stored in said bin assembly and in the plane into which the next rod traverses upon its being discharged from said assembly. Said platform is seen to extend substantially transversely over the rail members 52*a* and 52*b*, being slightly inclined downwardly and forwardly from the rear rail member 52*b* in the direction of conveyance of the rod R thus discharged and terminating at a point rearwardly of the front rail member 52*a* as viewed in FIG. 3. Said heating device also includes a platform 62 which is located on top of the aforesaid platform 61, preferably in predetermined spaced relation to the same, and as will be realized by the skilled artisan, said platform may be connected in circuit with a suitable source of electrical energy effective to rapidly heat said platforms and the space therebetween.

As a rod R is discharged from the bin assembly, its left hand end as seen in FIG. 3 falls upon the platform 61 and passes through the space between said lower and upper induction heater platforms 61 and 62, where said end is heated to a forging temperature. At the same time the right end of said rod R is likewise supported in coplanar relation to such heated end and for this purpose a pair of rail elements (not herein shown) are attached to the inner face of the bin wall 58 preferably in spaced relation to each other and in such manner that the upper surface of the lower rail element is in coplanar relation to the upper surface of the aforesaid heater platform 61. In this manner, the rod R is supported at each of its ends, said supporting surfaces as above mentioned being preferably inclined downwardly and forwardly of the bin assembly in such manner that the rod rolls down the same and toward the front end of the supporting frame 51.

Once heated, the rod R continues to move along its conveyance path, as defined by said supporting platform and rail elements, its ends being thereafter supported upon a pair of plates 65 and 66 carried on the aforesaid frame 51, the upper supporting edge thereof being closely adjacent and inclined slightly downwardly and forwardly from said platform and associated rail elements and terminating preferably at the vertical plane defining the front side of the frame 51.

As each rod R glides down the supporting plates 65 and 66 and reaches the front edges thereof, it rolls upon a pair of fingers 68 and 69 which as best seen in FIG. 3, are each mounted at one end thereof on a shaft member 70, the latter being preferably journalled at its ends within suitable bearing mounts 71 attached to the aforementioned rail member 52*a* of the frame 51. The fingers 68 and 69 are carried on said shaft in such manner as to be directly forwardly of the aforesaid supporting plates 65 and 66, respectively. The shaft member 70 is likewise mounted so that, as shown in FIG. 3 the free end of each of said fingers lies close to the forward edge of the adjacent plate 65 and 66 respectively and in such manner as to be substantially coplanar extensions to the latter as to define a continuation of said rod conveyance path.

Although not herein specifically shown, the shaft member 70 is preferably intended to be slightly pivotable in a counterclockwise direction, as viewed in FIG. 3, being thus effective to raise the free ends of the fingers 68 and 69 above the upper surfaces of the aforesaid plates 65 and 66 whereby the rod R gliding over the latter will strike said raised ends and hence be disrupted in its conveyance along said path. This interruption in said rod feed may be desired to stop the fabrication of the rod material without the necessity of shutting down any of the apparatus.

Said fingers may also be raised sufficiently to permit the rod R to pass freely underneath in which case said rod falls into an inclined chute D and which may thereafter be removed by the operator.

As is also seen in FIG. 3, suitable lengths of link chain as indicated by the reference numeral 73 may each be suspended from its upper end so as to hang vertically downwardly adjacent the front edge of each of said supporting plates 65 and 66 being effective to engage with the rod R as it transfers to the fingers 68 and 69 and thus momentarily slow the same down so as to enable to it be properly received by said fingers.

As each of said rods R rolls over the fingers 68 and 69, it is thence transferred onto a plurality of block elements identified by the reference numerals 75–77 in-

clusive, and which are also seen, particularly in FIG. 3, to be located across the front side of the aforesaid frame 51, each being mounted upon the upper edge of a triangular-shaped plate 78–80 respectively, the latter, in turn, being supported upon a shaft 81 journalled at its ends within bearing mounts 82 located forwardly of said frame 51, being preferably attached to the rearwardly disposed walls of a structural framework F, later to be referred to in greater detail, and in longitudinal prolongation to the aforementioned conveyance path. Said plates 78–80 are preferably disposed in spaced relation to each other as to locate block elements 75 and 76 closely adjacent the left hand bearing mount whereas block elements 77 is preferably located adjacent the opposite bearing mount. As will be later explained, the aforesaid block elements and associate structure are preferably selectively positioned along the supporting shaft 81 to accommodate various rod lengths. Each of said block elements is shown to have a forwardly inclined portion as identified respectively by the reference numerals 75*a*–77*a* the upper end of each of which is disposed in the plane traversed by the rod at the instant it leaves the support of the fingers 68 and 69, Said inclined portion thence extends downwardly and forwardly of said front side of the frame 51 along said conveyance path and terminates in a vertically disposed wall part, the latter being identified respectively by the reference numerals 75*b*–77*b*. As best seen in FIGS. 6 and 7, the lower end of the vertically disposed wall part on each of said block elements terminates a narrow, substantially horizontally disposed rim or shelf part identified in each instance by the corresponding reference numeral 75*c*–77*c*.

As each rod R leaves the support of the fingers 68 and 69 it falls upon the block elements 75–77, and thence rolls down the inclined portions thereof, along said conveyance path and engages with a stop member 84 (FIGS. 5 and 8) interposed in said path and preferably located to one side of the center block element 76. Upon engaging with said stop member, the conveyance of said rod R is temporarily discontinued, said stop member being thereafter actuated in predetermined timed relation to the cyclic operation of the header slide 15 as will be hereinafter disclosed, to release said rod and thus enable the same to fall into the aforementioned chute portions C (FIGS. 6 and 7) of said block elements.

As best seen in FIGS. 8–10, the stop member 84 is somewhat triangular in configuration and rigidly mounted adjacent its one corner on a pin 84*a*, the latter being carried within one end of an arm member 84*b*. Said arm member is hingeably mounted by means of pin 84*c* to a plate 85, the latter being rigidly attached to the aforementioned plate 79. The opposite end of said arm member is seen to be pivotally connected to one leg of a right angle bracket 85*a*, the remaining leg of said arm, as best seen in FIG. 10, being rigidly connected to a pivot arm 86. Said bracket in turn is pivotally mounted at the end of said latter leg part to said plate 79 in such manner as to suspend said pivot arm 86 downwardly and rearward of said shaft 81.

A cam 86*a* carried on said shaft 81 is keyed thereto and rotatable therewith as to engage with said pivot arm 86 and swing the same in a clockwise direction as viewed in FIG. 10 to thus likewise effect a clockwise rotation of said bracket 85*a* which, in turn, pivots the stop member 84 counterclockwise about its pin 84*a* to thus lower it below the upper surface of the inclined portion of the block eleent 76. When this occurs, the rod R previously disrupted in its conveyance by said stop member and retained thereby on said inclined portion is thence permitted to fall downwardly into the aforesaid chutes C and onto the shelf parts 75*c*–77*c*. As the cam 86*a* continues to rotate with its shaft 81, a suitable coil spring 86*b* connected to the pivot arm 86 and the conveyor frame F is effective to bias said arm counterclockwise viewed in FIG. 10, an adjustable pin 86*c* being engageable with said arm as to normally position the same in substantially a vertical plane.

Each of said rods is intended to be releasably retained upon the aforesaid shelf portions, and for this purpose a channel member 88, as best seen in FIG. 3, is located forwardly of the aforementioned supporting blocks 75–77 and rigidly secured at its ends to a pair of brackets 82 and 83. A pair of inverted U-shaped bracket members 89 straddle the channel member 88, each being preferably releasably secured thereto by means of suitable locking screws 92. One of each of said bracket members is preferably disposed closely adjacent one end of the channel member 88 so as to be located preferably directly forwardly of one of the two end block elements 75 and 77. Each of said bracket members rigidly mounts a plate 93 (FIG. 7) on its top face, each of said plates extending toward the inclined portion of said block elements. A T-shaped keeper element 95 (FIG. 7) is seen to be swingably mounted on the free end of each of said plates 93, the latter and the supporting bracket members being so disposed as to locate its associated keeper element slightly to one side of one of the aforesaid endmost block elements 75 and 77.

Each of said keeper elements, as thus mounted, is intended to be disposed forwardly of the adjacent rod element supporting block (75, 77), a distance slightly greater than the diameter of the rod material being fabricated. In addition, as best seen in FIG. 3, the upper end of each head part of each keeper element is provided with a shoulder 96 extending to the side thereof as to be suspended over its associated plate 93 and through which is threadably disposed an adjustable pin 97, the latter being adapted to be engageable with the upper face of said underlying plate 93 to thus limit the counterclockwise movement of said keeper element as viewed in FIG. 7. Said adjustable pin is preferably adjusted so as to locate the head part of its keeper element in substantially a vertical position. Each of said mounting plates 93, in addition, is provided with a boss 98 which carries a threaded pin 98*a* adapted to engage with the under side of the stem portion of the associated keeper element, said pin being likewise preferably adjustable as to locate the head part of said element in substantially a vertical position. As best seen in FIG. 7, the head part of each keeper element is preferably of such length that its bottom end, with said head part in its aforesaid vertical position is disposed forwardly and slightly above the shelf portion of its associated block element 75 or 77. In this manner, each of said keeper and block elements thus cooperate to define a pair of chutes C capable of receiving one or more of rods R as seen in FIGS. 6 and 7, being operable therefore to retain the same therein, and in position in said conveyance path for periodic delivery of said rod to the forging head. The chutes are preferably such dimension as to be capable of holding two of said rods R, however, as will be realized, said chutes may likewise be so constructed as to hold merely one, or more, of said rod lengths. As is also best seen in FIG. 7, a coil spring is utilized with each of said keeper elements, being indicated by the reference numeral 102, and is seen to have its one end anchored to the plate 93 and the opposite end thereof to the uppermost end of the head part of said keeper element 94 being thus effective to bias the same in a counterclockwise direction so as to normally position the aforesaid head part in its vertical position.

Means are provided to periodically dislodge a length of rod R from the aforesaid chutes C and to continue its conveyance along said path to the forging head.

For this purpose, the instant delivery and feeding apparatus is provided with a plurality of endless roller-type conveyor chains preferably three in number, as is identified by the reference numerals 104, 105 and 106, inclusive (FIG. 3). As best seen in FIG. 3, said conveyor chains are located forwardly of the aforesaid frame 51,

in predetermined spaced relation to each other, as to be suspended within the aforementioned conveyance path, and in close association with the previously mentioned rod supporting block elements 75–77.

Each of said conveyor chains and the mounting therefor is preferably substantially identical in construction, being carried within the aforementioned framework F, and hence conveyor chain 106 only will be described in detail, differences, if any, existing between the several conveyor chain assemblies being hereinafter specifically referred to.

As is best seen in FIGS. 3 and 7, each of said endless conveyor chains, reference being directed particularly to chain 106, is carried on a plurality of sprocket wheels, one of which as is identified by the reference numeral 108, being mounted on the aforementioned shaft 81, the latter being in turn rotatably journalled at its ends within the aforesaid triangular-shaped plate 80, and a companion plate 110, disposed closely adjacent the plate 80, to thus suspend the conveyor chain 106 therebetween. The conveyor chain is passed over said sprocket wheel 108, the latter being preferably disposed as to be directly rearwardly of and below its associated block element 75–77, to thus define the rearward bight of said conveyor chain.

As best seen in FIGS. 5 and 7, each conveyor chain is additionally carried on a pair of sprocket wheels 112 and 113, the former being suitably rotatably mounted adjacent the forward end of its respective triangular plate, as above mentioned, a stub shaft 114 journalled between plate 80 and companion plate 110 rotatably supporting sprocket wheel 112 for conveyor chain 106, whereas, a shaft 115 journalled to and extending between walls 116*a* and 116*b* of the aforementioned framework F thus provides support for the sprocket wheel 112 for each of the chains 104 and 105.

The remaining sprocket wheel 113 for the conveyor chain 106 is seen to be rotatably carried on a shaft 116, which is journalled at its ends within the aforesaid plates 80 and 110. Each of the sprocket wheels 113 of the remaining conveyor assemblies for conveyor chains 104 and 105, is carried on a common shaft (not shown) similar to shaft 116 being journalled at its ends within the aforementioned plates 78 and 79.

An additional sprocket wheel 120 is also provided for each of the aforesaid conveyor chains, said wheel as best seen in FIG. 7, being rotatably mounted on one end of an arm 121, the latter being swingably mounted at 122 to the adjacent triangular plate of its assembly in such manner that said sprocket wheel engages with the lower run of its associated roller chain. The arm 121, in turn, carries an adjusting screw 122*a* which is adapted to engage with a suitable projection 123 carried by said plate as to bias said arm 121 in a counterclockwise direction being effective to thus maintain the conveyor chain taut on its supporting sprocket wheels.

Each of said conveyor chains is provided with a plurality of pairs of lug elements 125 and 126 which, as best seen in FIG. 7, are disposed at predetermined intervals along each of said chains, each element of each pair, in addition being spaced apart a distance preferably slightly greater than the largest diameter of rod material capable of processing by the instant forging machine. The lug element 126 is seen to have an upper ejector part 126*a*, that projects outwardly of the supporting chain a distance somewhat greater than its companion lug element 125, the purpose for which will now be described.

As best seen in FIG. 7, each of the conveyor chains 104–106 is preferably carried on one of the aforementioned triangular-shaped mounting plates so as to have its rearward bight directly below and closely adjacent one of the shelf parts 75*c*–77*c* respectively, of the aforementioned block elements 75–77. The upper run of each chain thence extends forwardly along its mounting plate in the direction of the aforementioned conveyance path, and preferably is inclined downwardly along said path toward its sprocket wheel 112, the latter thus defining its foremost bight.

With the conveyor chains thus positioned, the lug element 126 of each of said pairs of elements is intended to be of such dimension as to locate its ejector part 126*a* in approximately the same plane as the shelf part of its associated block elements 75–77, respectively. As best seen in FIG. 5, the shelf part of each of said block elements is preferably cut out as is indicated by the corresponding reference numeral 75*d*–77*d*, respectively, to thus permit the ejector part to sweep past said shelf part and toward the keeper element 95 located forwardly thereof.

As the ejector part 126*a* of each lug element 126 sweeps through the shelf part it engages with the lowermost rod R disposed in the aforesaid chutes C and applies a force thereto in the forward direction along said conveyance path or to the left as viewed in FIG. 7.

As previously mentioned, each of the keeper elements 94 is swingably mounted forwardly of the block elements 75 and 77 so as to retain the lengths of rod R on the aforesaid shelf parts.

With this construction, as the ejector part 126*a* of each lug element 126 thus applies a force to the lowermost rod R, said force is applied, in turn, to the lower end of the head part of each of said keeper elements. Said force is effective to swing said keeper elements slightly clockwise as viewed in FIG. 7 to thus release said lowermost rod R from said chutes.

As the istant chute construction is preferably capable of accommodating two lengths of rods R, one above the other, it is necessary to prevent the upper rod R from being ejected with the other disposed therebelow.

For this purpose, a finger 127 as best seen in FIG. 8, is swingably mounted adjacent its upper end to the aforementioned plate 85 by pivot 126*a* on the side thereof opposite arm member 84*b* in such manner as to hang downwardly in front of the shaft 81. A cam element 127*a* is securely mounted on shaft 81 in such position as to engage said finger 127 and swing the same in a clockwise direction.

A semi-circular projection 128 is seen to be carried on the surface of the finger 127 adjacent its upper end on the side thereof facing the keeper element 95 cooperating with the block element 76.

As the lowermost rod R is ejected from the supporting shelf parts of the aforesaid chutes C during which time each of said keeper elements 95 is also swung in a clockwise direction as viewed in FIG. 7, the projection 128 is interposed between the rod to be ejected and the one thereabove to thus prevent the latter from being carried out of the aforesaid chutes. Subsequent to the ejectment of the lowermost rod R, during which time the shaft 81 is being driven, to thus propel the conveyor chain 106 in a counterclockwise direction as viewed in FIGS. 7 and 8, said shaft 81 is effective to rotate cam element 127*a* in the same direction as to engage with and swing the finger 127 in a clockwise direction.

With this actuation of said finger 127, the projection 128 is swung upwardly and rearwardly of the surface of the vertical part on the block element 76 as viewed in FIG. 8 to thus permit the rod R disposed thereabove to fall to the lower position in said chutes C as to rest upon the shelf parts 75*c*–77*c* thereof. The cam element 127*a* is so disposed on the shaft 81 as to engage with said finger 127 preferably after the keeper elements 95 have been returned to their normal vertical position by the associated coil springs 102 subsequent to the bottom rod R in said chutes being dislodged therefrom. A suitable coil spring 129 having its one end anchored to the free end of the finger 127 and its opposite end to a fixed part of the conveyor frame F is effective to bias said finger in a counter-clockwise direction; an adjustable pin 129*a* carried on the aforementioned plate 85 engaging with said finger as to normally locate the same preferably in a vertical plane, as is indicated in FIG. 8.

The previously described cam element 86*a* on shaft 81 for actuating the stop 84, is disposed on said shaft as to engage the pivot arm 86 therefor once per rotation of said shaft, and preferably at a time after the finger 127 has returned to its aforesaid vertical position so that the next rod R may be permitted to roll down the inclined portions of the block elements 75–77 and engage with the aforesaid projection 128.

As said lowermost rod is thus released, it falls upon the conveyor chains 104–106 between the lug element 125 located directly ahead of the ejecting lug element 126 and is thereby carried along the aforementioned conveyance path.

The preferred spacing for each pair of said lug elements 125—126 and hence the required velocity of the conveyor chains 104–106, are dependent upon the intended cyclic operation of the header slide 15, gripping dies 12 and 13, and the manipulating fingers 22 and 23, the functioning of the latter being in predetermined timed relation one to the other as will be hereinafter described.

Referring again particularly to FIGS. 3 and 7, the ejected length of rod R is carried upon the upper run of each conveyor chain forwardly along said conveyance path, and is thence transferred to feeding means now to be described and which are referred to herein as a "walking beam assembly," being identified in its entirety by the reference numeral 130.

To assist in the proper transfer of the rod R to the walking beam assembly, a guide rail 130*a* (FIG. 6) is disposed forwardly of the conveyor roller chain 104 and the plate 78, said rail having a curved guide surface 131*a* in position to direct the rod R forwardly and downwardly from the conveyor chain 104 and onto a threshold member 131*b* suitably carried on the aforesaid framework F and interposed between the guide rail and said conveyor chain. The guide rail 130*a* is pivotally carried on a bracket 131*c*, the latter being mounted on the aforesaid framework as to be swingable in a clockwise direction as viewed in FIG. 6.

The rod R, when carried by the conveyor chain 104, is momentarily disposed on the threshold member 131*b* and thereafter dislodged by the walking beam assembly in a manner hereinafter described.

In the instant forging machine embodiment, the walking beam assembly 130 is preferably operable in timed relationship with the previously mentioned manipulating fingers 22 and 23 to support in a generally horizontal position and successively move each length of rod R downwardly in preferably a vertical direction from said adjacent end of the aforesaid conveyor chains, the conveyance path for said rod R hence changing upon transferring to said assembly to a vertical direction as to successfully present each rod to the gripping dies 12 and 13 and to the header slide during the forging process.

In the present form of machine structure wherein lengths of rod material of approximately six feet are intended to be processed to form mine-roof bolts, it is preferred to have the "walking beam assembly" located forwardly of the conveyor roller chain 106 remote from the header slide so that it will provide support for the right end of the rod R as viewed in FIG. 3. As previously mentioned, the manipulating fingers are intended to support the rod R at a point closely adjacent the gripping dies 12 and 13 on the side thereof opposite the header slide 15.

As will also be hereinafter described the walking beam assembly is preferably constructed as to be capable of being adjustably moved transversely of and between the conveyor chains 105 and 106 toward or away from the gripping dies 12 and 13 to thus provide end support for various lengths of rods R.

With reference now directed particularly to FIGS. 11 and 12, the instant walking beam assembly includes a pair of stationary supporting plates 132 and 133, each of which is seen to be somewhat rectangular in overall configuration and rigidly attached at the rearward vertical edge thereof to a flat mounting plate 135 preferably in such manner as to extend perpendicularly forwardly thereof in a vertical plane and in substantial parallel spaced relation as to define an opening 136 therebetween. The mounting plate 135 is attached by means of suitable fasteners 137 to the front face of a spacer plate 138, the latter, in turn, having a pair of journal blocks 139 rigidly mounted to the opposite side thereof adjacent its upper and lower edges. As best seen in FIG. 11, each of said journal blocks 139 is preferably formed with an aperture 141, said blocks being thus slidably accommodated upon a pair of horizontally extending posts 119 preferably suspended between walls 116*a* and 117 of the supporting frame F.

As previously indicated, the walking beam assembly 130 as thus suspended is preferably adapted to be disposed closely adjacent the conveyor roller chain 106, and to extend in the same direction as the aforementioned conveyance path, the forwardly disposed vertical edges of the stationary support plates 132 and 133 being thus located in frame F slightly forwardly and downwardly from the terminus of the upper run of said chain.

As best seen in FIG. 12, a workpiece supporting head is fixedly attached to the forward edge of each supporting plate 132 and 133, said heads being identified respectively by the reference numerals 132*a* and 133*a*. Each of said supporting heads, in turn, is fastened to its associated plate as to be in substantial prolongation therewith; its forwardly disposed vertical edge having a plurality of recesses formed therein, substantially in equally spaced relation, the recesses of only head part 133*a* on plate 133 being herein identified respectively by the reference numeral 135*a*–135*d*; the recesses in said head parts corresponding to the number of recesses provided in each of the workpiece gripping dies 12 and 13, the purpose for which will be presently explained. The recesses in said supporting heads are disposed as to be in substantial alignment with each other, i.e., the uppermost recess in head 132*a* is intended to be in alignment with recess 135*a* in head 133*a*; etc.

In the process of fabricating each of the lengths of rod R, each of said rods is intended to be transferred into a pair of said aligned recesses at the same time said rod is moved by the manipulating fingers 22 and 23 into position as to be disposed within one of the die cavities in the aforesaid gripping dies, said rod being thus suspended and supported thereby preferably in a horizontal plane during each of the forging strokes of the header slide 15. At the completion of each forging stroke, the tail end of each of said rods R supported by the plates 132 and 133 of said assembly is then moved to the next lower pair of aligned recesses in said plates.

For this purpose, a plate 145, hereinafter referred to as a "walking beam" is disposed within the aforementioned opening 136 in parallel spaced relation to and between the stationary support plates 132 and 133, said walking beam, in addition, being similar in overall configuration to said plates, and likewise mounting a workpiece transferring head 146 on its forward, vertically disposed edge, said head being formed with a plurality of equally spaced recesses 147*a*–147*e*, which are seen to be similar in spacing and configuration to the aforementioned recesses in said stationary supporting plates.

During each forging stroke of the header slide 15, the walking beam 145 and the stationary support plates 132 and 133 are intended to be disposed in such relation that the recesses therein are in substantial alignment as to support the trailing end of each rod R in substantially a horizontal plane. That is to say, recesses 134*a* and 135*a* of plates 132 and 133 respectively, for example, are in substantial alignment with recess 147*a* in said walking beam 146, etc. At the completion of each forging stroke, the walking beam 145 is thence intended to be actuatable

simultaneously with the movement of the aforementioned manipulating fingers 22 and 23 as to carry the rod and/or rods R out of the recesses occupied thereby during the previous forging stroke of said header slide, downwardly and into the next pair of recesses in the gripping dies 12 and 13 disposed therebelow.

For this purpose, a pair of shaft members 148 and 149 as seen in FIG. 11, is journalled at the ends thereof within the aforesaid stationary support plates 132 and 133, preferably adjacent the upper and lower portions thereof as to be preferably vertically spaced one from the other and extending substantially in parallel spaced relation across the opening 136 defined therebetween. A circular cam element 150 is eccentrically mounted on each of said shaft members 148 and 149 each of said cam elements in turn, being disposed within a circular bore 152 formed within said walking beam 145 adjacent each end thereof.

With the construction thus far described, the shaft members 148 and 149 are intended to be simultaneously actuated as to move the walking beam 145 through substantially a circular orbit relative to said stationary plates 132 and 133 in a counterclockwise direction as viewed in FIG. 11.

To accomplish this, a cam drive shaft, as is indicated by the reference numeral 153, is rotatably journalled within the aforementioned stationary support plates, closely adjacent the mounting plate 135 therefor. The rearward edge of the walking beam 145 is preferably formed with a suitable recess as is indicated at 155, into which is accommodated the aforementioned drive shaft 153 to thus enable said walking beam to move freely through its orbit. The drive shaft 153 mounts a drive gear 156 which, in turn, is adapted to mesh with identical drive pinions 157 and 158 similarly mounted upon the aforementioned shaft members 148 and 149 respectively. As best seen in FIG. 11, the driving engagement between the drive gear 156 and pinions 157 and 158 is preferably synchronized so that the cam elements 150 on said shaft members 148 and 149 are each disposed in exactly the same portion of its associated bore 152.

The cam drive shaft 153 is intended to be drivingly rotated, by means later to be described in detail, in a clockwise direction as viewed in FIG. 11, to provide the aforesaid circular orbital movement of the walking beam 145 to thus accomplish the transfer of the rod and/or rods R supported by said assembly to the next lower pair of recesses in said stationary support plates 132 and 133.

The instant walking beam assembly also includes a keeper bar 160, as best seen in FIGS. 11 and 12 which is preferably disposed in a vertical plane in front of the stationary plates 132 and 133 and said movable walking beam 145, being adapted to lie against the front edges of the land portions thus defined between the aforesaid recesses formed on the head parts 132*a*, 133*a* and 146 thereof and thereby operative to retain the lengths of rod R within said recesses during their fabrication.

A guide rail 160*a* mounted on the aforementioned bracket member 83 as to be suspended above said keeper bar 160 is effective to direct the rod R into position to be picked up by the walking beam 145.

Said keeper bar 160 is intended to be movable by the walking beam 145 during the latter's orbital actuation to retain said lengths of rod R within the recesses 147*a*–147*e* of said transferring head mounted on said beam while the same are moved to the next lower position in the supporting plates 132 and 113.

For this purpose, the keeper bar 160 is swingably attached at its medial part, as is indicated at 162, to the upper end of an arm member 163, said arm member at its opposite end (not shown) is suitably swingably mounted to the adjoining machine framework F. Any suitable biasing means for example, a coil spring or the like (not herein shown) may be utilized to bias said keeper arm 160 against the front edge of the aforementioned stationary supporting plates 132 and 133 and walking beam 145 of said assembly.

With this construction, it will be realized that upon the walking beam 145 being actuated in a counterclockwise direction through its circular orbit as viewed in FIG. 11, the keeper bar 160 will swing first to the left as said walking beam is moving in the same direction, and thereafter to the right as said walking beam moves downwardly and rearwardly between the aforementioned stationary supporting plates 132 and 133 to thus assist in the transfer of the lengths of rods R to the next lower recesses in said supporting plates.

As previously mentioned, the functioning of the workpiece delivery and feeding apparatus of the present invention is intended to be synchronized with the cyclic operation of the header slide 15, the workpiece gripping dies 12 and 13, and the manipulating fingers 22 and 23, said components being thus operable in a predetermined timed relation with one another during each forging cycle of said forging machine.

To accomplish this purpose, the prime source of energy (not herein shown) for the instant forging machine may be any conventional type of unit such as an electric motor, and which may be drivingly connected to the header slide 15 and gripping dies 12 and 13 in a manner similar to that disclosed in my aforesaid Patent 2,011,106, being thus effective to reciprocally drive said header slide in a horizontal direction toward and away from the gripper dies 12 and 13, and as to cyclically actuate the latter to a closed or open position in timed relation to the reciprocation of said slide.

As best seen in FIGS. 1 and 13, a drive shaft 180 is intended to be connected to said energy source and mount a suitable sprocket 181 on its forward end over which is passed an endless drive chain 182. Said chain is also passed around sprocket 183 carried on a transfer shaft 184, the latter being journalled within opposed walls 185 and 186 of a suitable housing 187 disposed adjacent the aforementioned housing for the fingers 22 and 23.

A cylindrical bushing 189 is disposed on the transfer shaft 184, having a bevel pinion formed on its inner end thereof as indicated at 190, which pinion is adapted to mesh with a ring gear 191 the latter, in turn, being carried on the aforementioned shaft 37.

The transfer shaft 184, likewise carries a bushing 193 adjacent gear housing wall 186, which in turn, is provided with a bevel pinion 194 on its one end. Said pinion 194 is seen to be in mesh with a suitable bevel ring gear 195 carried on the upper end of bearing 196, the latter being disposed on and securely fastened to the upper end of a shaft 197.

The shaft 197, as best seen in FIG. 4, has its opposite end journalled in gear transfer box 201, said box having, in turn, an output shaft 202 journalled therein and connectable with said shaft 197. The output shaft 202 is seen to extend diagonally rearwardly of the aforementioned framework F and has its opposite end suitably journalled within a second gear transfer box 203. Said transfer box 203, in turn, also has an output shaft 204 connectable to said shaft 202, and which thence projects upwardly therefrom, being journalled within gear transfer unit 206 mounted vertically above gear box 203.

The aforementioned drive shaft 153 for the walking beam 145 is seen to have its remote end journalled within said transfer unit 206 as to be drivingly coupled to the shaft 204, and hence positively drivably connected through the drive train just described to the prime source of energy for the forging machine.

A typical cycle of operation of the delivery and feeding apparatus of the present invention, in conjunction with the manipulating fingers 12 and 13 and header slide 15 will now be described.

With reference directed particularly to FIG. 5, it will be seen that rotation of the shaft 153, connected in the manner above described to the prime power source, is

operable by means of drive pinion 156 and drive gear 157 to effect the rotation of shaft member 148. As a result, the sprocket wheel 112 is also rotatably driven to thus propel the endless conveyor chain 106 forwardly along the aforesaid conveyance path.

With the actuation of conveyor chain 106, the sprocket wheel 108 associated therewith is likewise rotatably driven so as to drive its shaft 81.

The rotatable actuation of said shaft 81 through the remaining sprocket wheels 108 is thence effective to cause the conveyor chains 104 and 105 to also be driven in the same direction as chain 106. In this manner therefore the several components of the delivery and feeding apparatus of the present invention are actuatable by the prime energy source.

The relationship between the various components of the instant delivery and feeding apparatus and the manipulating fingers 22 and 23, the gripping dies 12 and 13 and the header slide 15 in order to effect a continuous forging process will now be described.

Assuming that a length of rod R has previously been ejected from the bin assembly 55 and has been lodged within the aforesaid chutes C, the ejector lug element 126 on each conveyor chain, next to be carried into the upper run so as to sweep past the shelf part on its associated block element 75–77, dislodges the said rod and carries the same as above described, along the conveyance path toward the walking beam assembly 130.

The walking beam 145 of said latter assembly 130 then, in cooperation with the manipulating fingers 22 and 23, supports and successively carries the rod R downwardly between the gripping dies 12 and 13. And, as previously mentioned, the gripping dies are periodically closed to grasp said rod R therebetween and the header slide 15 thence moves forwardly in its forging stroke toward said dies to deliver a forging blow to the projecting end of the rod R, whereupon said header slide reciprocally moves.

In order that the forging process is continuous, it will be realized that a length of rod R has to be delivered to the walking beam assembly for transfer thereby to the gripping dies 12 and 13 once per each reciprocal actuation of the header slide 15.

To accomplish this, it is therefore required that the shaft 81 and its gear train connecting with the prime energy source be of such character as to propel the conveyor roller chains 104–106 along the conveyance path at such velocity that a rod R is dislodged from the chutes C by the ejecting lug elements 126 during each cyclic actuation of the header slide 15. In other words this means that the upper run of the conveyor chains 104–106 has to be advanced along and in the direction of the aforesaid conveyance path a minimum distance equal to the distance between adjacent pairs of lug elements 125, 126 on said conveyor chains. Said lug elements are, in addition, preferably located on the aforesaid conveyor roller chains as to deliver the rod R to the walking beam 145 during the interval when the header slide 15 is returning to its remote position.

In like manner, the drive shaft 153 is intended to be rotatably driven in such manner as to move the walking beam 145 through its circular orbit once per each reciprocal actuation of the header slide 15. As is previously mentioned, the walking beam 145 is preferably utilized herein with the workpiece manipulating fingers 22 and 23 of my copending structure to successively deliver and carry the rod R through the gripping dies 12 and 13. And, as is also previously mentioned, the workpiece manipulating fingers 22 and 23 are actuated while the header slide 15 is returning to its remote position away from said gripping dies. Hence, it is required that the cyclic actuation of the walking beam 145 be at exactly the same time and with the same velocity as that of the aforesaid fingers 22 and 23.

As is previously mentioned, after each length of rod R has been completely fabricated, the instant machine embodiment requiring four forging strokes of the header slide 15, said rod is thence deposited on a suitable conveyance means located below said slide and gripper dies for discharge to a storage or receiving bin.

For this purpose, the instant machine structure includes an endless conveyor roller chain 210, which as best seen in diagrammatic form in FIG. 5 extends longitudinally along the machine frame as to have its one end directly underneath the gripping dies 12 and 13. Said endless chain is preferably supported on a pair of sprocket members 212, one of which is carried in a drive shaft 213, the latter connecting in turn, to a suitable energy source such as electric motor 214.

With this construction, said conveyor chain 210 is intended to be driven so as to propel its upper run to the left as viewed in FIG. 5 to thus carry the rod R disposed thereon to and along a rail 215 of the receiving bin, said rail being disposed in substantial longitudinal prolongation with respect to said conveyor chain and supported in a raised horizontal plane upon a suitable housing 216.

Said rod is thereafter intended to be dislodged from the rail 215, and onto a plurality of supporting members 217 which are seen to be connected at one end to said rail and extend forwardly and downwardly therefrom transversely across said housing 216.

For this purpose, a sweeper bar 218, FIG. 1, is hingeably connected at its ends to said housing above the aforesaid rail 215, and is swingable across the latter by any suitable means such as fluid motor 219 to sweep the rod R deposited on said rail onto the aforesaid members 217.

Upon said rod R being deposited on said supporting members 217 it may thereafter be removed by the operator and stored at any convenient location.

Having thus described in detail a preferred embodiment of the delivery and feeding apparatus of the present invention, it will now be realized that the same may be utilized with various other material fabricating machines and is susceptible of various combinations, modifications and arrangements of parts without departing from the scope of the appended claims.

What is claimed is:

1. In a forging machine of the class described having a forging head reciprocal along a plane and a pair of workpiece gripping dies adjacent said head each provided with a series of workpiece gripping recesses in spaced coplanar relation thereon in a direction transverse to said plane and a pair of workpiece gripping fingers actuatable to move a workpiece between said dies for successively disposing the same adjacent opposed recesses and said gripping dies being closed in predetermined timed relation to the reciprocation of said forging head as to securely hold said workpiece in said opposed recesses while work is performed thereon by said head; the combination therewith of workpiece delivery and feeding apparatus for presenting a workpiece to said dies, comprising frame means adjacent said forging head, plate means on said frame means for supporting the ends of a workpiece while the latter moves thereon along a path laterally of said plane, a plurality of block elements disposed in said path, a first part on each of said block elements for receiving said workpiece from said plate means as to continue the movement of said workpiece along said path, shelf means on each of said block elements for receiving said workpiece from said first part being operable to interrupt the movement of said workpiece along said path, conveyor means extending along said path, ejector means at predetermined intervals along said conveyor means, said conveyor means being continuously movable along said path to carry said ejector means periodically into engagement with a workpiece on said shelf means effective to dislodge the latter from said shelf means and discharge the same onto said conveyor means, said ejector means thence being engageable with said discharged workpiece for directing its conveyance along said path by said conveyor means, and means for receiving said

workpiece from said conveyor means for supporting said workpiece as it is moved through said dies.

2. In a forging machine as defined in claim 1 and wherein finger means are interposed between said plate means and said block elements and selectively actuatable to interrupt the movement of said workpiece along said path.

3. In a forging machine of the class described having a forging head reciprocal along a plane and a pair of workpiece gripping dies adjacent said head each provided with a series of workpiece gripping recesses in spaced coplanar relation thereon in a direction transverse to said plane and a pair of workpiece gripping fingers actuatable to move a workpiece between said dies for successively disposing the same adjacent opposed recesses and said gripping dies being closed in predetermined timed relation to the reciprocation of said forging head as to securely hold said workpiece in said opposed recesses while work is performed thereon by said head; the combination therewith of workpiece delivery and feeding apparatus for presenting a workpiece to said dies, comprising frame means adjacent said forging head, a plate mounted on opposite sides of said frame means for supporting the ends of a workpiece while the latter moves thereon along an inclined path laterally of said plane, a plurality of block elements disposed in and extending substantially transversely across said path, a first part on each of said block elements extending along said inclined path being disposed to receive said workpiece from said supporting plates and effective to continue the movement of said workpiece along said path, shelf means on each of said block elements for receiving said workpiece from said first part being operable to interrupt the movement of said workpiece along said path, a conveyor chain disposed in said path, a pair of lug elements carried on said conveyor chain in predetermined spaced relation thereon, said conveyor chain being continuously movable along said path to periodically carry one of said lug elements into engagement with a workpiece on said shelf means effective to dislodge the latter from said shelf means and discharge the same onto said conveyor chain between said lug elements, said lug elements being operable to thereafter direct the conveyance of said workpiece of said conveyor chain along said path, and means for receiving said workpiece from said conveyor for supporting said workpiece as it is moved through said dies.

4. In a forging machine of the class described having a forging head reciprocal along a plane and a pair of workpiece gripping dies adjacent said head each provided with a series of workpiece gripping recesses in spaced coplanar relation thereon in a direction transverse to said plane and a pair of workpiece gripping fingers actuatable to move a workpiece between said dies for successively disposing the same adjacent opposed recesses and said gripping dies being closed in predetermined timed relation to the reciprocation of said forging head as to securely hold said workpiece in said opposed recesses while work is performed thereon by said head; the combination therewith of workpiece delivery and feeding apparatus operable with said gripping fingers for presenting a workpiece to said dies, comprising frame means adjacent said forging head, a plate mounted on opposite sides of said frame means for supporting the ends of a workpiece while the latter moves thereon along an inclined path laterally of said plane, a plurality of block elements disposed in and extending substantially transversely across said path, a first part on each of said block elements extending along said inclined path being disposed to receive said workpiece from said supporting plates and effective to continue the movement of said workpiece along said path, shelf means on each of said block elements for receiving said workpiece from said first part being operable to interrupt the movement of said workpiece along said path, a conveyor chain disposed in said path, a pair of lug elements carried on said conveyor chain in predetermined spaced relation thereon, said conveyor chain being continuously movable along said path to periodically carry one of said lug elements into engagement with a workpiece on said shelf means effective to dislodge the latter from said shelf means and discharge the same onto said conveyor chain between said lug elements, said lug elements being operable to thereafter direct the conveyance of said workpiece of said conveyor chain along said path, plate means adjacent said conveyor chain, a series of recesses in spaced relation thereon, and said conveyor chain being operable to deposit said workpiece onto said plate means for supporting said workpiece as it is moved through said dies.

References Cited in the file of this patent

UNITED STATES PATENTS

807,362	De Long	Dec. 12, 1905
2,011,106	Lamprecht	Aug. 13, 1935
2,058,698	Lehman	Oct. 27, 1936
2,176,188	Poole	Oct. 17, 1939
2,377,294	Belada	May 29, 1945
2,832,971	Tesch	May 6, 1958
2,835,152	Lamprecht	May 20, 1958
2,856,802	Hercik	Oct. 21, 1958
2,997,725	Friedman	Aug. 29, 1961

FOREIGN PATENTS

942,184	Germany	Apr. 26, 1956